Forest Health Protection

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"Evaluation of verbenone treatments for the prevention of mountain pine beetle (Dendroctonus ponderosae) attacks on lodgepole pine at Lookout Pass Ski and Recreation Area 2003-2007".

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EXECUTIVE SUMMARY

The forests in and around Lookout Pass Ski and Recreation Area have a significant component of lodgepole pine susceptible to mountain pine beetle (*Dendroctonus ponderosae*)(MPB) attack. Aerial Detection Surveys (ADS) began to detect lodgepole pine mortality attributed to mountain pine beetle in the vicinity of the recreation area in the mid 1990's.

In 2007, the fifth annual application of verbenone, the anti-aggregation pheromone for MPB, was made to forested strips between ski runs at Lookout Pass Ski and Recreation Area to protect susceptible lodgepole pine trees from MPB attack. The 2007 application differed from earlier applications. From 2003-2006 two applications of Pherotech Inc.'s 5-gram verbenone pouch were made. The first application was made in late May, early June and the second application was made in mid-July. In 2007 Beetle Block Verbenone 7-gram pouch produced by Synergy Semiochemical Corporation was the only EPA registered verbenone product available. One application of 20 pouches Beetle Block Verbenone per acre was made in early June.

Evaluation surveys conducted in the fall of 2007 documented new MPB attacks in some treated forested strips. Attacks appeared to be recent at the time of the evaluations in October. MPB in north Idaho typically fly in July.

Based on 2007 evaluations, MPB attacks are present in treated forested strips but at a level lower than what would have been expected had no treatment been made. An application of verbenone in high priority forested strips in 2008 is advisable to prevent mountain pine beetle mortality. In addition managers might want to consider individual tree protection with insecticidal sprays for certain high value trees or for all trees in important forested strips to protect against MPB and pine engraver (*Ips* Species) (IPS) attack (verbenone is not effective against IPS). Insecticidal sprays have been effective in preventing bark beetle attacks on high value trees when applied properly.

Long term solutions to the bark beetle threat on Lookout Pass Ski and Recreation area will require silvicultural prescriptions which address the susceptibility of the forests in the forested strips to bark beetle attack.

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INTRODUCTION

Lookout Pass Ski and Recreation Area operates under a Forest Service special use permit administered by the Idaho Panhandle National Forest (IPNF). Located on the border of the IPNF and Lolo National Forests, the recreation area has provided winter recreation opportunities for over 69 years. The forests in and around the recreation area have a significant component of lodgepole pine susceptible to mountain pine beetle (*Dendroctonus ponderosae*) (MBP) attack. If MPB were to infest the forests of the ski hill without management, many of the larger diameter lodgepole pine trees in forested buffer strips between designated ski runs could be killed.

In order to protect the lodgepole pine in forested strips between existing ski runs, the IPNF requested Forest Health Protection (FHP) assistance. FHP has provided suppression funding annually since 2003 to treat from 40 (2003) to 130 (2006/07) acres of forested strips having large-diameter lodgepole pine with verbenone, the anti-aggregation pheromone for MPB. The IPNF also conducted an extensive survey of forested strips on the existing ski hill, and on forested strips between new runs that were created in the summers of 2003 and 2005.

This report summarizes information on the 2003-2007 verbenone application and a post treatment evaluation of 2007 treated units. It also discusses the 2008 FHP suppression request.

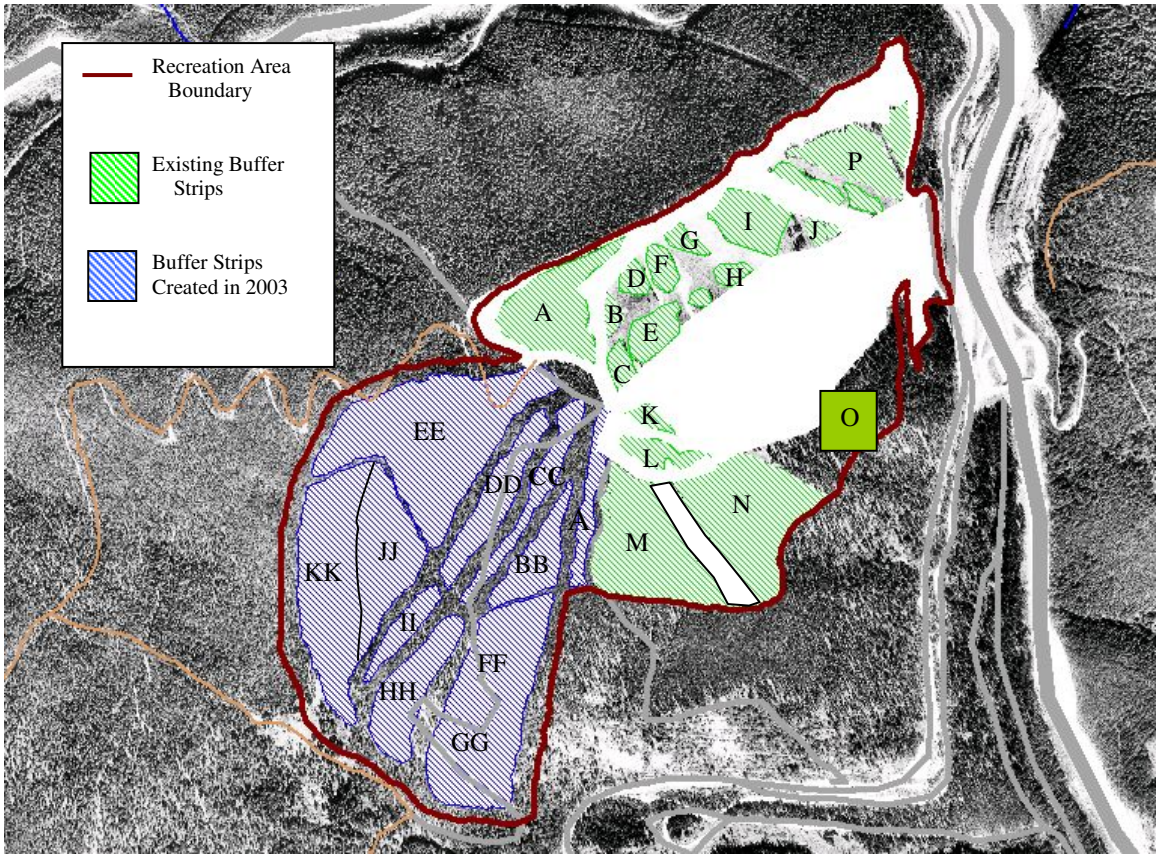
TREATMENT HISTORY

Applications of verbenone began on the ski hill in 2003, when 40 acres of susceptible forested strips were treated. The treatment area was expanded in 2004 to cover 100 acres, 120 acres in 2005, 126 acres in 2006, and 130 acres in 2007 (Table 1, Figure 1, Appendix 1).

TABLE 1: Verbenone treatment history for forested strips on Lookout Pass Ski and Recreation Area (Figure 1).

Area	Treatment					Area	Treatment				
	2007	2006	2005	2004	2003		2007	2006	2005	2004	2003
A&B	Yes	Yes	No	No	Yes	O	No	No	Yes	No	No
C	Yes	Yes	Yes	Yes	Yes	P	Yes	Yes	Yes	No	No
D	No	No	No	No	Yes	AA	Yes	Yes	Yes	Yes	No
E	Yes	Yes	No	No	Yes	BB	Yes	Yes	Yes	Yes	No
F	No	No	No	No	Yes	CC	Yes	Yes	Yes	Yes	No
G	No	No	No	No	Yes	DD	Yes	Yes	Yes	Yes	No
H	Yes	Yes	No	No	Yes	EE	Yes	Yes	Yes	Yes	No
I&J	Yes	Yes	Yes	Yes	Yes	FF	Yes	Yes	Yes	Yes	No
K	Yes	Yes	Yes	Yes	Yes	GG	No	No	No	No	No
L	Yes	Yes	Yes	Yes	Yes	HH	Yes	Yes	Yes	Yes	No
M	Yes	Yes	Yes	Yes	Yes	II	Yes	Yes	Yes	Yes	No
N	Yes	Yes	Yes	Yes	No	2007-Additional 8 acres treated below Skiway, M, & N					

FIGURE 1: **Lookout Pass Ski and Recreation Area Ski Hill Schematic Spring 2003. Green polygons (A-P) represent buffer strips between established runs in the spring of 2003. Blue polygons (AA-KK) represent buffer strips between runs created through harvest in the summer of 2003. .**



2007 TREATMENT

In 2007 we used the 7-gram Beetle Block Verbenone pouch produced by Synergy Semiochemical Corporation. This was the only EPA registered verbenone product available that year. The larger pouch is designed to last the entire flight period of the mountain pine beetle. No second application of verbenone is recommended by the manufacturer when using the 7-gram pouch. We stapled 20 7-gram verbenone pouches per acre to trees on a 15 meter grid.

As we applied the verbenone we noted 2006 MPB attacked trees which were green, but would change to red that fall. While the presence of 2006 attacked trees was disappointing, the number of trees attacked was lower than would have been anticipated based upon the susceptibility of trees in the forested strips and the level of beetle activity in the forests surrounding the ski and recreation area. There was significant beetle pressure in the vicinity, and it is my belief that there would have been significantly more red trees in the forested strips between ski runs had we not applied verbenone over the past 5 years. The fact that the 2006 attacked trees were green indicated attacks occurred later in the year. Trees attacked during the traditional peak flight period of the MPB begin to fade by September of the attack year.

2007 RESULTS

In October 2007 FHP Personnel evaluated 14 of the 18 verbenone treatment areas at Lookout Pass using the Forest Insect and Disease Tally

System (FINDITS). Anywhere from 2 to 10 ten basal area factor (BAF) variable radius plots were randomly placed within treatment polygons. Diameter at breast height (DBH), species, and MPB activity (current attack, last year's attack, older attacks, unattacked) were recorded for each tree on the plot. Data was then summarized using the FINDITS program (Bentz 2000).

FINDITS survey results on 2007, 2006, and older mountain pine beetle attacks are summarized in Table 2 for evaluated treatment areas.

Treatment efficacy in 2007 was highly variable. In some of the treatment units no MPB losses were recorded (F, K, AA, CC, DD, EE); in others losses were similar to losses experienced in 2006 (N, P, BB), and in a couple of units losses in 2007 were much higher than losses in 2006(M, FF).

It is not possible to determine why results were variable. In many of the units experiencing MPB mortality, MPB infested trees were present prior to 2007 treatments (the trees were attacked in 2006 and MPB brood were completing development in 2006 killed trees as verbenone was being applied in spring 2007). Many researchers feel that if currently infested trees are present in a treatment area, the beetle produced aggregation pheromones will overpower man made sources of anti-aggregation pheromone.

Another possible explanation for poor treatment results could be due to the change in the formulation of verbenone. Evaluation crews noted that the 2007 attacks observed appeared to be recent, within the past few weeks (evaluation occurred in October 2007 so attacks are thought to have occurred in September, 2007). MPB typically has peak flight in north Idaho in July. In past years we made two applications of 5-gram pouches, one in late May/ early June and a second in early to mid-July. With the 7-gram pouches we only applied once in early June. It is possible that the pouches stopped releasing verbenone before the end of MPB flight allowing MPB to make successful late season attacks.

TABLE 2: FINDITS survey results for verbenone treated polygons on Lookout Pass Ski and Recreation area, 2007. Grey shaded rows represent unit with 2007 MPB attacks.

Polygon (# Plots)	Treatment History			2007 MPB Attacks TPA	2006 MPB Attacks TPA	Older MPB Attacks TPA
	2007	2006	2005			
A&B (8)	**Yes**	**Yes**	**No**	**0.9**	**6.6**	**7**
F(2)	**No**	**No**	**No**	**0**	**59**	**0**
K(2)	**Yes**	**Yes**	**Yes**	**0**	**0**	**0**
L(2)	**Yes**	**Yes**	**Yes**	**7.9**	**40**	**0**
M(9)	**Yes**	**Yes**	**Yes**	**48.5**	**8.9**	**1.2**
N(10)	**Yes**	**Yes**	**Yes**	**23.3**	**25.9**	**10.2**
P(10)	**Yes**	**Yes**	**Yes**	**4.3**	**4.5**	**11.2**
AA(3)	**Yes**	**Yes**	**Yes**	**0**	**0**	**0**
BB(4)	**Yes**	**Yes**	**Yes**	**3.9**	**5.2**	**3.7**
CC(4)	**Yes**	**Yes**	**Yes**	**0**	**0**	**0**
DD(5)	**Yes**	**Yes**	**Yes**	**0**	**0**	**0**
EE(10)	**Yes**	**Yes**	**Yes**	**0**	**0**	**0**
FF(10)	**Yes**	**Yes**	**Yes**	**27.2**	**5.5**	**3.8**
Below Skiway (10)	**Yes**	**No**	**No**	**12**	**18.2**	**31**

RATE OF LOSS PREDICTION

A 10-year rate of loss prediction model developed by Cole and McGregor (1983) was run on survey information collected in the fall of 2007 from the forested strip polygons. Results are summarized in Table 3. Cameron et al. (1990) found that in areas where MPB populations became established predictions of mortality using the Cole McGregor model were within 25% of the actual mortality observed.

In most of the forested strips between ski runs on the ski hill, continued mountain pine beetle activity may result in significant losses to the lodgepole pine component.

TABLE 3: Cole-McGregor (1983) mountain pine beetle in lodgepole pine 10-year rate of loss prediction model (if beetle populations become established in a stand) results for leave strip polygons surveyed in 2006 (shaded) and 2007 on the Lookout Pass Ski and Recreation Area.

Polygon:	Acres:	Stand Hazard:	Pre-Outbreak LP Pine TA	Estimated 10-Yr Post Outbreak LP Pine TA	Estimated % LP Pine TA Lost
A&B	10.0	HIGH	162	35	78%
E	2.5	MOD	78	1	99%
F	1.3	MOD	61	17	72%
H	0.8	MOD	60	23	62%
I&J	5.5	MOD	134	31	77%
K	1.1	LOW	245	4	98%
L	2.5	LOW	455	131	71%
M	12.1	HIGH	501	120	76%
N	14.4	LOW	90	39	57%
P	9.6	MOD	152	113	26%
AA	2.96	MOD	585	124	79%
BB	4.69	HIGH	380	35	91%
CC	4.25	HIGH	507	88	83%
DD	5.96	HIGH	538	79	85%
EE	25.03	HIGH	763	71	91%
FF	11	HIGH	212	102	52%
HH	6.94	MOD	309	81	74%
II	2.52	HIGH	270	96	64%
Strip Below Skiway		HIGH	214	65	70%

SUMMARY OF BEETLE RELATED FINDINGS

The lodgepole pine trees and forests in and around Lookout Pass Ski and Recreation Area are susceptible to bark beetle attack. Many of the forested strips between ski runs on Lookout Pass are comprised primarily or exclusively of lodgepole pine. They would be substantially altered if beetle populations became established and lived up to their potential for tree killing (Table 3). Suppression efforts including the harvesting of currently infested trees and area treatments with the anti-aggregation pheromone verbenone in 2007/2008 may prevent additional MPB caused lodgepole pine mortality.

Surveys in untreated areas show that mountain pine beetle continues to kill trees in and around the ski hill.

While the use of verbenone may have reduced MPB caused mortality, it is not effective in preventing attacks by other bark beetles such as IPS. IPS, often associated with logging activity and wind throw, has been active on the ski hill in recent years, though no current activity was documented during evaluations in the fall of 2007. Wind throw during the winter of 2007-2008 will create a new potential food source for IPS beetles.

RECOMMENDATIONS

- Many factors point to a potentially substantial and short-term reduction in the lodgepole pine component of the ski hill. While direct suppression efforts may increase the longevity of lodgepole pine in the short term, it would be prudent to consider what options are available to compensate for ongoing losses of this species. An evaluation of the current conditions and threats to the vegetative component of the Lookout Pass Ski and Recreation Area would assist managers as they plan the future of the ski hill.

- An application of verbenone in high priority forested strips in 2008 is advisable. In addition managers might want to consider individual tree protection using insecticidal sprays for certain high value trees or for all trees in important buffer strips to protect against MPB and IPS attack (verbenone alone is not effective against IPS). Please contact FHP for current insecticide recommendations.

- Removal of currently infested lodgepole pine trees in polygons A/B, L, M, N, P, BB, FF, and below the skyway on the Montana side should be considered.

- Green wind thrown trees or slash should be removed from within and around the recreation area as soon as is practicable in the spring of 2008. If left on or near the ski hill, this material may act as a breeding ground for IPS beetles, resulting in additional losses of green trees or top kill.

- MPB continues to kill lodgepole pine trees in forested strips in spite of efforts to protect trees using verbenone. While verbenone may be slowing the rate of loss in the lodgepole component, it is unlikely that it will stop. Implementation of a vegetation management plan would be helpful as the District deals with the continued MPB activity in the Ski and Recreation Area. Prevention and restoration strategies should be considered rather than the current emphasis on verbenone based suppression strategies. FHP will no longer be able to supply funds to continue the current suppression strategy beyond 2008.

FY 2008 SUPPRESSION REQUEST

The IPNF requested funding to treat 130 acres in the Lookout Pass Ski and Recreation Area with verbenone in 2008. Polygons were prioritized for treatment using the following criteria: %BA lodgepole pine, location of the polygon on the ski hill, mountain pine beetle hazard rating, and average diameter of the lodgepole pine component. Treatment polygons, stand ID's, number of acres, and number of verbenone pouches required to treat them are summarized in Table 4. The overall costs of verbenone treatments on Lookout Pass Ski and Recreation Area from 2003-2008 are summarized in Table 5.

TABLE 4: Proposed 2008 verbenone treatment areas between ski runs on Lookout Pass Ski and Recreation Area . (Refer to Figure 5 for polygon location).

Polygon	Stand ID	Acres	# Verbenone Pouches
A&B		10	200
C	116-03-066	1.2	23
E		2.	50
H		1	20
I	116-03-073	5.5	110
J	116-03-074	1	21
K	724-01-024	1	19
L	724-01-025	2.43	49
M	724-01-026	11	218
N&Adjacent O	724-01-027	21.5	430
P	116-03-077	8.36	167
AA	724-01-013	3	59
BB	724-01-012	4.7	94
CC	724-01-011	4.3	85
DD	724-01-009	6	119
EE	724-01-008	25	501
FF	724-01-014	11	220
HH	724-01-012	7	139
II	724-01-010	2.5	150

TABLE 5: Total costs for verbenone treatments to protect lodgepole pine in forested areas between ski runs at Lookout Pass Ski and Recreation Area from 2003 through proposed 2008 treatment.

Year	Pre treatment Surveys (Acres)	Treatment (Acres)	Post treatment Surveys (Acres)	Indirect Costs	Total Cost
2003	$2000 (500)	$8,800 (40)	$200 (40)		$11,000
2004	$1,500	$23,500 (100)	$750 (100)	$5,923 (23%)	$31, 673
2005		$30,400 (120)	$750 (120)		$31,150
2006	$1,280 (20)	$34,400 (129)	$1,720 (129)	$2,200	$39,600
2007		$22,500 (130)			$22,500
2008		$23,500 (130)	$2,000 (130)		$25,500
Total	**$4,780**	**$143,100**	**$5,420**	**$8,123**	**$161,423**

LITERATURE CITED

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APPENDICES

Appendix 1: 2007 Verbenone Application on Lookout Pass Ski and Recreation Area:

Stand ID	Area (Acres)	Forested Strip Letter
116-03-063	10	A
116-03-065	1	B
116-03-066	1	C
116-03-069	2	E
116-03-072	1	H
116-03-073	6	I
116-03-074	1	J
724-01-024	1	K
724-01-025	2	L
724-01-026	11	M
724-01-027	14	N
116-03-077	8	P
724-01-013	3	AA
724-01-012	5	BB
724-01-011	4	CC
724-01-009	6	DD
724-01-008	25	EE
724-01-014	11	FF
724-01-012	7	HH
724-01-010	3	II
724-01-031	4	4 Acres Below Skiway
724-01-005	4	4 Acres Below Skiway
TOTAL	130 Acres	

Appendix 2: 2006 Evaluation Survey Results

Polygon	Treatment History			2006 MPB Attacks TPA	2005 MPB Attacks TPA	Older MPB Attacks TPA
	2006	2005	2004			
A&B	Yes	No	No	0	20.9	0
E	Yes	No	No	0	0	0
F	No	No	No	55.8	0	0
H	Yes	No	No	0	0	0
I&J	Yes	Yes	Yes	0	4.7	8.8
K	Yes	Yes	Yes	0	0	0
L	Yes	Yes	Yes	0	0	0
M	Yes	Yes	Yes	3.7	0	0
N	Yes	Yes	Yes	56.3	2.0	5.5
P	Yes	Yes	No	37.2	12.3	5.3
AA	Yes	Yes	Yes	0	0	0
BB	Yes	Yes	Yes	0	0	0
CC	Yes	Yes	Yes	0	0	0
DD	Yes	Yes	Yes	0	0	0
EE	Yes	Yes	Yes	0	0	0
FF	Yes	Yes	Yes	6.8	0	0
HH	Yes	Yes	Yes	33.4	0	2.5
II	Yes	Yes	Yes	0	0	0
Strip	No	No	No	24.0	27.0	26.2